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News in Science - Quasar shows star birth at dawn of time - 25/07/2003

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Quasar shows star birth at dawn of time

Wilson da Silva
ABC Science Online

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The oldest object known, a superhot quasar powered by a black hole a billion times larger than our Sun, has been found to harbour molecular gas - suggesting stars were forming as early as 13 billion years ago.

The discovery, by a team of U.S. and European astronomers led by Dr Fabian Walter of the [National Radio Astronomy Observatory](#) in New Mexico, USA, indicates large quantities of molecular hydrogen were created rapidly in even the youngest galaxies. Their report appears in the latest issue of the journal, [Nature](#).

"This is important because it is molecular gas out of which stars form," Walter told ABC Science Online. "That's very nice proof that star formation was going on even that far back in the history of the universe."

The quasar, an extremely distant celestial object pumping out several thousand times the energy of our entire galaxy, is embedded in a distant galaxy known as J1148+5251. "The light from that quasar travelled 13 billion years to reach us here on Earth ... [it left] when the universe was only one-sixteenth to today's age - that's only around 800 million years after the Big Bang," Walter said.

The team detected vast quantities of carbon monoxide. The only atoms formed by the Big Bang at the very dawn of the universe were hydrogen and helium. Carbon and oxygen - the atoms making up carbon monoxide - had to be made in the thermonuclear furnaces at the cores of the earliest stars.

"Carbon and oxygen are elements that have to be produced in stars, and the mere fact that we see carbon monoxide at these early times tells us that there must have been a generation of stars



This 13-billion-year-old quasar, in red, was already packed with the stuff stars are made of; it's called J1148+5251 (*Keck*)

actually producing that gas - which pushes back the earliest epoch of star formation," he said.

The carbon and oxygen atoms detected were made by some of the first stars ever formed, about 650 million years after the Big Bang. In the next 200 million years or so, those stars - likely different from any we see today - exploded as supernovae, casting the carbon and oxygen made in their cores across the cosmos.

"Those atoms then cooled and combined into the carbon monoxide molecules we detected with our radio telescopes," said Walter, who is attending the [25th General Assembly of the International Astronomical Union](#) in Sydney this week.

The quasar was producing these gases when the universe was only just emerging from the primeval 'dark ages' - a time before light could travel freely through the cosmos, when the universe was different from the one we know today.

"After the Big Bang, everything was an extremely hot place. It took a long time - about 300,000 years - for the universe to cool down and actually form atoms. We believe the quasar we've found was one of the very first luminous sources," he said.

And there was a lot of the molecular gas found: more than 10 billion times the amount found in the Sun, telling astronomers that things were happening much faster in the early universe than had been thought.

The team used the Very Large Array of 27 radiotelescope dishes in New Mexico, coupled with the Plateau de Bure radio interferometer in France. Combining radio observations with data from optical telescopes showed that the visible bubble of mass around the nascent galaxy was about 30 million light-years in diameter.

with Pauline Newman, Radio National

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